



System-Wide Water

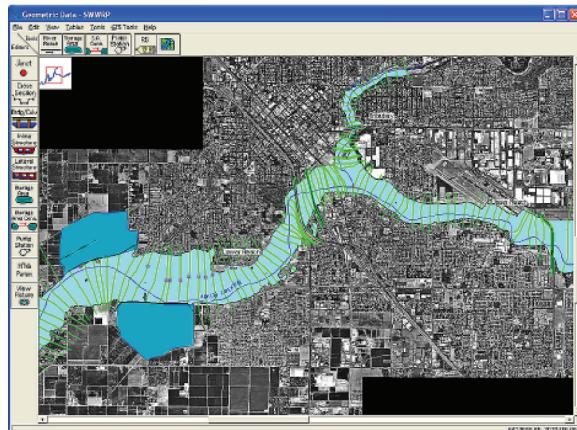
SWWRP
 Resources Program

Hydrologic Engineering Center-River Analysis System (HEC-RAS)

Description: The U.S. Army Corps of Engineers' Hydrologic Engineering Center-River Analysis System (HEC-RAS) is an integrated system of software, designed for interactive use in a multitasking environment. It allows simulation of one-dimensional (1-D) steady and unsteady flow, water surface profile calculations and inundation mapping. The system comprises a graphical user interface (GUI), separate hydraulic analysis components, data storage and management capabilities, graphics and reporting facilities.

Existing capabilities include:

- **Analysis Features:** Steady flow water-surface profiles; unsteady flow simulations; movable boundary sediment transport computations; and water quality analysis. Additionally, options are available for: Federal Emergency Management Agency (FEMA) floodway encroachments; split flow optimization; sediment transport capacity and bridge scour; dam and levee breaching, navigation dam operations, channel modifications, mixed flow regime, sediment budget analysis, and model calibration features.
- **Geometric Features:** Bridge hydraulics – extensive culvert hydraulics (nine types of culverts), multiple opening analysis (bridges and culverts), inline structures (spillways, gates and weirs), lateral structures (gates, weirs, culverts, and rating curves), storage/ponding areas, hydraulic connections between storage areas, pumping stations, floating ice, levees, extensive data import and export, and GIS connections.
- **Graphical Output:** Water surface profile plots, cross sections, rating curves, stage and flow hydrographs, generalized profile plot of any variable (i.e., velocity), 3-D view of river system, and graphical animations.
- **Tabular Output:** Detailed output tables for XS and all structures, summary output tables, and user defined output.



Application: Users of HEC-RAS include: All Corps District and Division Offices; USDA Natural Resources Conservation Service (NRCS) and Federal Highway Administration (FHWA) which has adopted it for 1-D River Hydraulics over their own software; other Federal agencies including FEMA, U.S. Geological Survey (USGS), U.S. Bureau of Reclamation (USBR), National Weather Service (NWS), Fish and Wildlife; state and local governments; private industry; environmental organizations, universities, and engineers worldwide.

Studies using HEC-RAS include:

- Initial screening and reconnaissance studies
- Feasibility investigations and alternative evaluations



**US Army Corps
of Engineers®**

Engineer Research
and Development Center

[more ...](#)

Hydrologic Engineering Center-River Analysis System (HEC-RAS)

- Design studies; real-time forecasting
- Spatial scale of application (small urban areas with small drainage systems, moderate-size river systems with natural and constructed channels, large-scale river systems)
- Time scale of applications (peak flow profiles, single event simulations, long-term simulations)

Recent Notable Projects using HEC-RAS include:

- **Sacramento – San Joaquin:** Comprehensive evaluation of system operation and alternative analysis
- **Mississippi River:** 1-D unsteady flow models by all districts along river
- **Columbia River and Tributaries:** General flood damage reduction analysis and real-time forecasting
- **Susquehanna River, PA:** Flood warning system and FEMA mapping
- **Truckee River, NV:** Flood damage reduction analysis and ecosystems evaluation
- **Anacostia River, MD:** Flood damage reduction
- **Rogue River, OR, Watershed:** Real-time forecasting
- **Jefferson Parish, LA:** Highly urban interconnected canals and pump systems
- **East Branch of CA SWP:** Enlargement study for California state water project canal
- **New Orleans Interior Flooding Analysis – Hurricane Katrina Study**
- **Joseph Sayers Dam, PA, State of Hawaii Dams:** Dam break simulation and mapping

Benefits: This research work will improve the Corps' ability to analyze the movement of water for large-scale river systems. The integration of HEC and ERDC tools will allow for the modeling of complex systems that require both 1-D and 2-D solutions simultaneously. This research work will lead to more accurate solutions for better planning, engineering, and operational decisions. In addition, it will reduce modeling costs and create new business opportunities for USACE. Model results for application in plan formulation will be more readily available as standard output, thus reducing the manual steps and time required to complete large-scale studies.

Future Capabilities: The current version of HEC-RAS supports steady and unsteady flow water surface profile calculations, movable bed sediment transport computations, and water quality analysis (temperature modeling and transport of a limited set of constituents). New features and additional capabilities targeted include: additional hydraulic computational components; linking 1-D HEC-RAS with 2-D ADH; additional bed mixing and transport algorithms, unsteady flow sediment transport, and additional water quality constituents.

Points of Contact: Gary Brunner, U.S. Army Corps of Engineers, Hydrologic Engineering Center, (530) 756-1104, Gary.W.Brunner@usace.army.mil;

Mark Jensen, U.S. Army Corps of Engineers, Hydrologic Engineering Center, (530) 756-1104, Mark.Jensen@usace.army.mil;

Cameron Ackerman, U.S. Army Corps of Engineers, Hydrologic Engineering Center, (530) 756-1104, Cameron.Ackerman@usace.army.mil;

Stan Gibson, U.S. Army Corps of Engineers, Hydrologic Engineering Center, (530) 756-1104, Stanford.Gibson@usace.army.mil.